Hydrogen Peroxide (H₂O₂) Monitoring

Decontamination, sterilisation, infection control and residual gas monitoring for medical, education, leisure and care facilities
Intelligent Solutions from ATi UK

ATi are a specialist manufacturer of analytical sensors.

We are a trusted global supplier to the healthcare and pharmaceutical industry, delivering outstanding results in the most challenging environments. Our pioneering and innovative Pharmasafe range of engineered gas detection solutions for decontamination and sterilisation applications are relied upon the world over and come with our award-winning customer support.
Hydrogen Peroxide (H\textsubscript{2}O\textsubscript{2})

Hydrogen peroxide (H\textsubscript{2}O\textsubscript{2}) is an extremely strong oxidiser widely used in the deep cleaning and decontamination of medical, education, leisure and care facilities. Used in these environments it will destabilise any molecule it can react with such as those that make up microorganisms.

Certain facilities use equipment or have areas that require continuous sterilisation or regular decontamination. Hydrogen peroxide is used because of its effectiveness in killing bacteria and microbes, however hydrogen peroxide is also a high strength oxidant and is dangerous to all living cells.

The best way to ensure safety of staff working in these departments is to monitor and alarm where levels exceed that of the exposure guidelines, by using fixed or portable detection with a reliable and accurate hydrogen peroxide sensor.
Monitoring background levels of H₂O₂ in the workplace is not easy. ATi are one of the only gas sensor companies in the world that can make an accurate sensor that can be used to protect staff. H₂O₂ is released into the air during the decontamination process (fogging) and ought to be monitored as part of your Quality Controls Program.

Monitoring for chemicals such as H₂O₂ enable you to effectively manage the breathing environment, this continuous monitoring allows you to validate that the vapour in the air is safe and can also be used to demonstrate and prove that staff and patients are at no risk when working in these potentially hazardous areas.

Rooms, surfaces and equipment can be sterilised multiple times per day with higher levels of H₂O₂ than ever before, increasing the risk to those working close to them.

Generating the right amount of gas is vital for efficacy over prolonged periods, it is therefore essential to understand and accurately monitor H₂O₂ levels with a pre-calibrated monitor.
COSHH Assessment

‘The Control of Substances Hazardous to Health Regulations 2002 (COSHH) requires employers to prevent or control exposure to hazardous substances. Where exposure cannot be prevented, employers are required to assess the risk to health, and provide adequate control measures when using hazardous chemicals’.

Health and Safety Executive

Ref: https://www.hse.gov.uk/food/disinfectants.htm
The ATi UK range of Hydrogen Peroxide fixed and portable monitoring solutions
Model H10-34 hydrogen peroxide sensor is an electrochemical device used for the selective detection of hydrogen peroxide gas in ambient air.

H₂O₂ sensors operate by generating a small electrical current proportional to the partial pressure of peroxide gas in the surrounding air. The current is the result of the direct oxidation of hydrogen peroxide on the surface of the measuring electrode to form oxygen as shown in the equation below.

Each ATi® smart sensor is a sensor, amplifier and memory module in one compact package. This unique and innovative design allows our smart sensors to be factory pre-calibrated, ready to be simply plugged into any one of our monitors for immediate use. When installed in a gas detector, calibration data is loaded into the microprocessor, so that no adjustments are needed. The result is a gas detector that, for example, can go from measuring hydrogen peroxide to peracetic acid in less than one minute.

The hydrogen peroxide smart sensor is used in conjunction with ATI's Model D16 PortaSens III portable leak detector or F12/D fixed, toxic gas monitor.

For further details please contact us on sales@atiuk.com
Fixed Hydrogen Peroxide Monitor
F12/D

The F12D (H₂O₂) monitor is a continuous detector that can be positioned anywhere in a room to alarm for if safe limits are hit. The system uses a pre-calibrated sensor that requires an annual replacement with no calibration.

The system can be used independently with options for connectivity to an existing Central/Fire alarm system. The display of the unit can be positioned outside of a room with the sensor positioned close to the stored source or where staff work. The F12/D fixed (H₂O₂) monitor is manufactured by ATi, who are one of only a few gas sensor manufacturing experts operating in this type of industry. The chemists at ATi are experts in electro-chemical sensors and have made a system that does not require calibration. The sensor can be replaced each year without fuss and without resource to minimise staff intervention.

The ATi fixed (H₂O₂) monitor has a built-in data logging facility for historical data capture which can then be used to prove or disprove claims of exposure. The system gives ‘peace of mind’ to the health & safety staff that all stakeholders are protected with alerts or if limits are exceeded.

**Note:** The F12/D monitor also has the optional capability of being fitted with a traffic light visual strobe, indicating safe (green), caution (amber) and do not enter (red) signalling.

For further details please contact us on sales@atiuk.com
Portable Hydrogen Peroxide Monitor

D16 PortaSens III

The D16 PortaSens is a versatile, portable leak detection system that uses the same sensor technology as our fixed (H₂O₂) monitor.

This innovative device is a handheld monitor which uses a pump to speed up gas detection for the protection of staff, yet still offers alarms and a data logging facility. The D16 portable system can be carried around and is vital for efficacy over prolonged periods, re-entering a room after decontamination, performing audits, checking for leaks and for protection whilst H₂O₂ is being used.

A unique feature of the D16 gas detector is its ability to measure a variety of different gases by simply inserting the appropriate sensor for that gas. That makes this gas detector capable of measuring over 60 different gases or vapors, reducing the need to purchase individual detectors for each type of gas. The gas sensors for the detector can be changed quickly and easily, and there is no need for calibration when a gas sensor is changed.

The D16 PortaSens III contains 4 Gb of data storage and data is easily transferred to a computer through its USB port. No special software is needed as the PortaSens III appears as an external drive as soon as it connects to your PC.

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ATi’s ground-breaking and unique AutoTest feature has transformed the industry, making our F12/D hydrogen peroxide monitor, the ONLY monitor that automatically generates gas and tests itself daily, greatly reducing operator testing requirements and making it the safest product in the world.

A major expense in gas detection systems is the cost of regular testing to ensure that sensors are responding. This requires a technician to inspect sensors weekly and apply a small amount of gas manually to check response. ATi has developed a unique system to reduce this maintenance requirement.

Available on most ATi digital sensor/transmitters, this option consists of an electrochemical gas generator closely coupled to the sensor. Every 24 hours, the receiver automatically activates the generator, producing a small amount of gas that diffuses into the sensor, just as it would if a gas leak occurred. The microcomputer in the receiver analyses the output of the transmitter to determine that the sensor is responding normally. When proper sensor response is detected, the generator is turned off and the system goes back to normal operation. If no sensor response is detected, the trouble light on the receiver will flash and the trouble relay will activate. During testing, alarm relays are inhibited so that external alarms are not activated.

The ATi AutoTest feature ensures that each sensor is regularly tested with gas. Premature sensor failure or blockage of the sensor membrane is quickly detected. In addition, self-testing will alert maintenance personnel when a sensor has reached the end of its useful life. Since sensors normally last anywhere from 12 months to over 3 years, this feature allows users to determine when sensor replacement is needed.
The benefits of using ATi Hydrogen Peroxide smart sensor technology

- ATi manufactured, interchangeable sensors for quick replacement
- Pre-calibrated sensor with full certification
- Annual replacement with no calibration reduces staff responsibility
- Visual and audible alerts when limits are met
- Reduces the need for a costly and time consuming maintenance schedule
- Built-in data logging facility for historical data capture
- Acts as an early warning system for staff well-being
- Same sensor technology used in both fixed and portable monitors
- Accurate and reliable sensors proven through years of industry experience
- Cost-effective solution offering complete peace of mind
- Access to ATi UK’s award winning customer support

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Applications

The ATi fixed F12/D and portable D16 PortaSens III can be used in a variety of applications, offering complete confidence and peace of mind while maintaining the safety of your staff in the workplace.

- Decontamination
- Sterilisation
- Infection control
- Residual Gas Monitoring
- Leakage
- Spillage
- Risk assessment

For further details please contact us on sales@atiuk.com
Exposure to Hydrogen Peroxide
What are the Occupational Exposure Limits for $\text{H}_2\text{O}_2$?

<table>
<thead>
<tr>
<th></th>
<th>LTEL (8 hour reference period)</th>
<th>LTEL (15 minute reference period)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ppm mg/m$^3$</td>
<td>ppm mg/m$^3$</td>
</tr>
<tr>
<td>WEL</td>
<td>1 1.4</td>
<td>2 2.8</td>
</tr>
</tbody>
</table>

WEL: Workplace Exposure Limit  
LTEL: Long Term Exposure Limit  
STEEL: Long Term Exposure Limit

These figures relate to most of the EU, USA and UK.  
Other countries may have occupational exposure limits that differ.

Reference:  
Health and Safety Executive (HSE) EH40/2005 Workplace Exposure Limits, 2nd Edition 2011
The high reactivity of hydrogen peroxide that underlies its benefits also means that excessive exposure to the vapour can be harmful and can cause health issues.

Health risks due to exposure of $\text{H}_2\text{O}_2$ include:

1. Permanent damage to lungs
2. Permanent damage to eyes/sight
3. Damage to ‘mucous membranes’
4. Burns to skin
Technical Specification and Best Practice
# Low Range and High Range Hydrogen Peroxide Smart Sensors

## Operational and Performance Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Response</strong></td>
<td>Volume % Hydrogen Peroxide ($H_2O_2$)</td>
</tr>
<tr>
<td><strong>Measuring Range</strong></td>
<td>Low range 0 – 100 PPM / High range 5 – 2000 PPM</td>
</tr>
<tr>
<td><strong>Sensor Current</strong></td>
<td>Low range 0.20 $\mu$A/PPM Nominal / High range 0.05 $\mu$A/PPM Nominal</td>
</tr>
<tr>
<td><strong>Sensor Current Variability</strong></td>
<td>Low range 0.10 – 0.50 $\mu$A/PPM / High range 0.02 – 0.10 $\mu$A/PPM</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>± 3%</td>
</tr>
<tr>
<td><strong>Response Time</strong></td>
<td>$T_{50} \leq 20$ Seconds, $T_{90} \leq 150$ seconds</td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>-20°C to +50°C</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>Internal e² memory for Calibration Data and Calibration History</td>
</tr>
<tr>
<td><strong>Pressure Range</strong></td>
<td>- 5 to + 50 PSIG</td>
</tr>
<tr>
<td><strong>Pressure Variability</strong></td>
<td>Output proportional to peroxide partial pressure</td>
</tr>
<tr>
<td><strong>Operating Humidity</strong></td>
<td>0-99% RH Non-condensing (Intermittent)</td>
</tr>
<tr>
<td></td>
<td>20-95% RH Non-condensing (Continuous)</td>
</tr>
<tr>
<td><strong>Zero Stability</strong></td>
<td>± 2 PPM at constant temperature</td>
</tr>
<tr>
<td></td>
<td>± 3 PPM over ±10°C ambient temperature change</td>
</tr>
<tr>
<td><strong>Span Drift</strong></td>
<td>&lt; 2%/Month</td>
</tr>
<tr>
<td><strong>Operating Life</strong></td>
<td>&gt; 24 Months Typical in Clean Conditions</td>
</tr>
<tr>
<td><strong>Storage Recommendation</strong></td>
<td>Recommended maximum of 1 year for best sensor performance</td>
</tr>
<tr>
<td></td>
<td>Store at less than 25°C in a sealed container</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>1&quot; D x 1.25&quot; H (25 mm x 32 mm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>17 grams</td>
</tr>
</tbody>
</table>

*Data subject to improvement without notice*
Best Practice for Safety and Accuracy

- Safety limit to re-enter a room after fogging is < 1 PPM. ATI make a low range sensor that accurately tracks the levels of \( \text{H}_2\text{O}_2 \) down to this level. The resolution of the \( \text{H}_2\text{O}_2 \) sensor is specially designed for this type of application.

- Keep the sensor freshly calibrated and charged by using the specifically designed ‘sensor keeper’ which keeps the sensor ‘ready to go’ all the time.

- The D16 PortaSens III comes with a wand and continuous pump to allow for quick monitoring that can be used at arm’s length to offer better protection to staff.

- Zeroing the sensor after each clean will allow the sensor to clear previous levels of gas ready for the next use.

- ATI laboratories uses \( \text{H}_2\text{O}_2 \) calibration gas and not \( \text{SO}_2 \) like other manufacturers.